Fibocom

Perfect Wireless Experience
完美无线体验

H380 M.2 Series Module Hardware User Manual

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Date：2015.08.19

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Attention

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Trademark

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Versions

Version	Date	Remarks
V1.0.0	2014-03-20	Initial Version.
V1.0.1	2014-04-18	1， Update the reference value of the current part. 2， Update the GPS function. 3， Update the temperature.
V1.0.2	2014-06-20	Add the supported description of Win8/Android dual-system switched.
V1.0.3	2015-02-26	Add the new types.
V1.0.4	2015-04-21	Add the top view in PCB Layout part. 部
V1.0.5	2015-05-20	1. Update the description of copyright and attention. 2. Update the translation of all the whole document .
V1.0.6	2015-08-19	Update the logo.

Applicability Type

No.	Type	Note
1	H380-Q50-00	
2	H380-A50-00	
3	H380-B50-00	

The difference of H380 M.2 series wireless module as listed below:

Model No.	GSM/GPRS/EDGE Band(MHz)	WCDMA Band(MHz)	HSDPA (Mbps)	HSUPA (Mbps)
H380-Q50-00	850&900&1800&1900	850&900&1900&2100	21	5.76
H380-A50-00	900&1800	900&2100	21	5.76
H380-B50-00	850&1900	850&1900	21	5.76

Content

1 Foreword

1.1 Introduction

The document describes the electrical characteristics, RF performance, dimensions and application environment, etc. of H380 M.2 series wireless communication modules. With the assistance of the document and other instructions, developers can quickly understand the performance of H380 M.2 series wireless communication modules and develop products.

1.2 Reference Standard

The design of the product compiles with the following standards ：

- 3GPP TS 27.007 -v6.9.0: AT command set for User Equipment (UE)
- 3GPP TS 27.005 -v6.0.1: Use of Data Terminal Equipment -Data Circuit terminating Equipment (DTE-DCE) interface for Short Message Service (SMS) and Cell Broadcast Service (CBS)
- 3GPP TS 23.040 -v6.9.0: Technical realization of Short Message Service (SMS)
- 3GPP TS 24.011 -v6.1.0: Point- to - Point (PP) Short Message Service (SMS) support on mobile radio interface
- 3GPP TS 27.010 -v6.0.0: Terminal Equipment to User Equipment (TE-UE) multiplexer protocol
- 3GPP TS 27.060 -v6.0.0: Packet domain; Mobile Station (MS) supporting Packet Switched services
- 3GPP TS 25.304-v6.10.0: User Equipment (UE) procedures in idle mode and procedures for cell re selection in connected mode
- 3GPP TS 25.308 -v6.4.0: High Speed Downlink Packet Access (HSDPA); Overall description;Stage 2
- 3GPP TS 25.309 -v6.6.0: FDD enhanced uplink; Overall description; Stage 2
- 3GPP TS 23.038 -v6.1.0: Alphabets and language - specific information
- 3GPP TS 21.111 -v6.3.0: USIM and IC card requirements
- 3GPP TS 31.111 -v6.11.0 "USIM Application Toolkit (USAT)"
- 3GPP TS 45.002 -v6.12.0: Multiplexing and multiple access on the radio path
- 3GPP TS 51.014 -v4.5.0: Specification of the SIM Application Toolkit for the Subscriber Identity Module - Mobile Equipment (SIM-ME) interface
- 3GPP TS 51.010 -1 -v6.7.0: Mobile Station (MS) conformance specification; Part 1: Conformance specification
- 3GPP TS 22.004 -v6.0.0: General on supplementary services
- 3GPP TS 23.090 -v6.1.0: Unstructured Supplementary Service Data (USSD); Stage 2

- 3GPP TS 24.008 v6.19, Mobile radio interface Layer 3 specification;
- PCIe_M.2_Electromechanical_Spec_Rev0.9-3_07312013_RS_Clean[1]

2 Product Overview

2.1 Description

H380 M.2 series are highly integrated 3G wireless modules, supports GSM/GPRS/EDGE and UMTS/ HSDPA / HSUPA/HSPA+，GPS/GNSS(supported in future).

2.2 Specification

Specification	
Operating Frequency Range	UMTS (WCDMA): 850/900/1900/2100MHz
	GSM/GPRS/EDGE: 850/900/1800/1900MHz
Data Rare	UMTS/HSDPA/HSUPA 3GPP release 7
	HSUPA 5.76Mbps (Cat 6)
	HSDPA 21Mbps (Cat 14) 或 7.2Mbps (Cat 8)
	GSM 3GPP release 7
	EDGE (E-GPRS) multi-slot class 33(296kbps DL，236.8kbps UL)
	GPRS multi-slot class 33(107kbps DL，85.6kbps UL)
GPS	GPS/GNSS（supported in future）
Physical Characteristics	Dimension：42mm x 22mm x 2.35 mm
	Interface：M.2
	Weight：5.0 grams
Environment	Operating Temperature：-30℃ ~ +75℃
	Storage Temperature：-40℃ ~ +85℃
Performance	
Operating Voltage	Voltage：3.135V ~ 4.4V Normal：3.3V
Current Consumption (Typical Value)	3mA (Sleep Mode)
	3G Talk：660mA
	2G Talk：270mA (GSM PCL5)
Rx Power (Typical Value)	Class 4 (2W)： 850/900 MHz, GSM
	Class 1 (1W)：1800/1900 MHz, GSM
	Class E2 (0.5W)： 850/900 MHz, EDGE

	Class E2 (0.4W)：1800/1900 MHz, EDGE
	Class 3 (0.25W)： 900/850/1900/2100 MHz, WCDMA
Tx Sensitivity (Typical Value)	UMTS/HSPA：-109dBm
	GSM：-108dBm
Interfaces	
RF Interface	Antenna：Mainx1，Diversityx1(RF diversity and GPS Aux)
Function Interface	1 x USB 2.0，Multiple Profiles over USB
	I2C Support，I2S/PCM Support
	GPIO
Data Features	
Protocol Stack	Embedded TCP/IP and UDP/IP protocol stack
EDGE	Multi-slot class 33 (5 Down; 4 Up; 6 Total)
	Coding Scheme MCS1~9
GPRS	Multi-slot class 33 (5 Down; 4 Up; 6 Total)
	Coding Scheme CS1~4
CSD	UMTS(14.4kbps)，GSM(9.6kbps)
USSD	Support
SMS	MO / MT Text and PDU modes
	Cell broadcast
Audio	Digital Audio
	Voice Coders: EFR/HR/FR/AMR
Audio Control	Gain Control
Character Set	IRA，GSM，UCS2，HEX
AT Commands	FIBOCOM proprietary AT commands
	GSM 07.05
	GSM 07.07
Accessories	Firmware Loader Tool over USB
	User Manual
	Developer Kit

2.3 Appearance

The product appearance of H380 M.2 series wireless module is shown as below:

Top View：

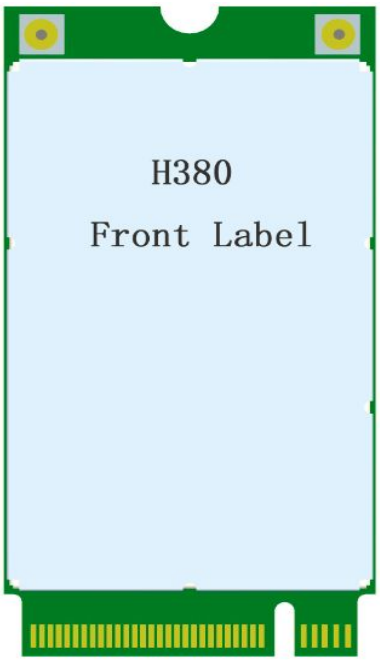


Figure 2- 1 Top View

Bottom view:

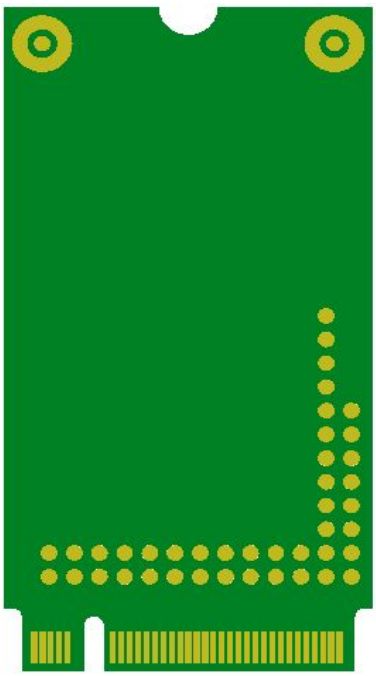
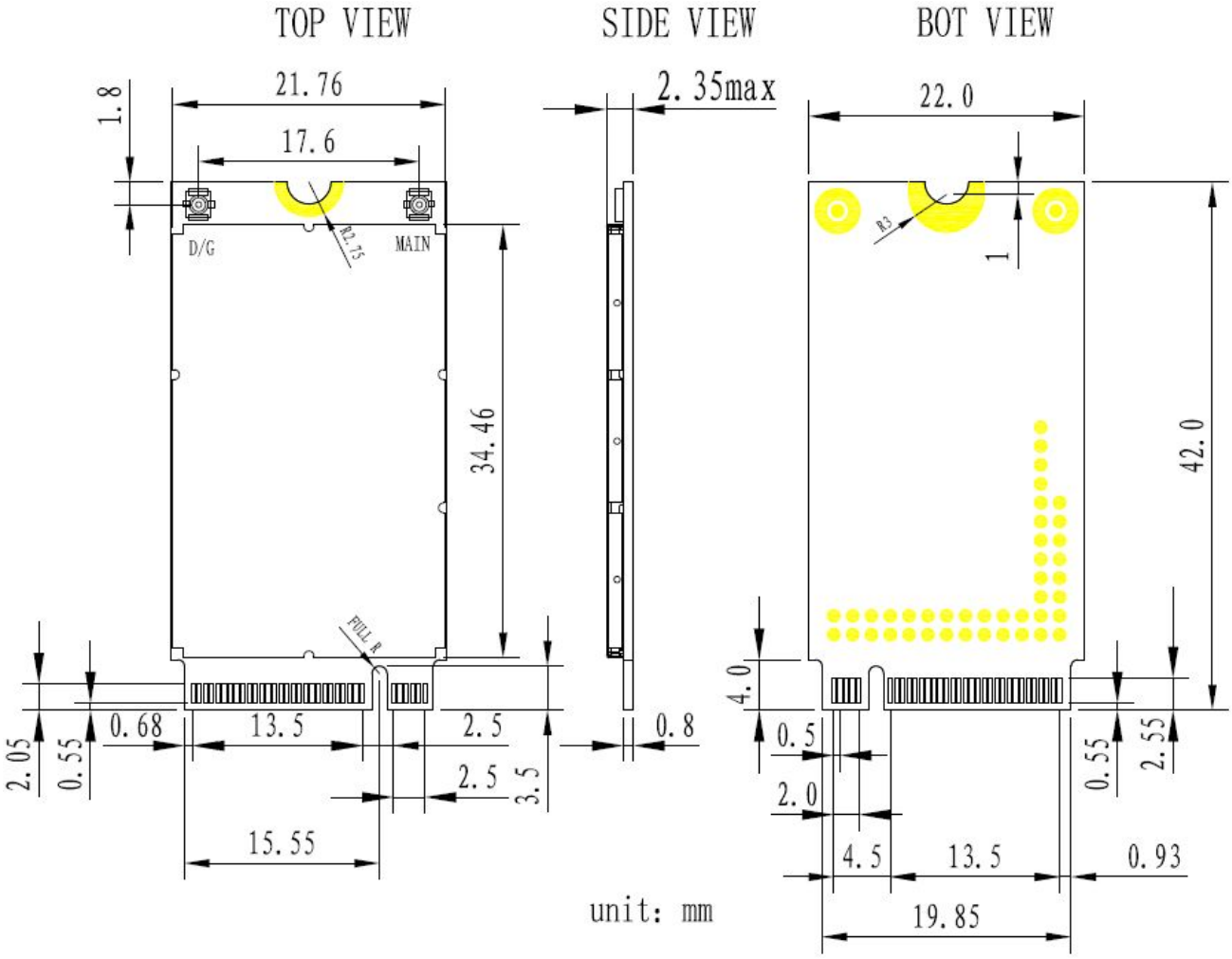
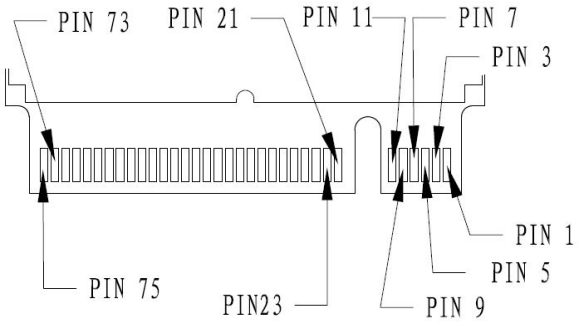


Figure 2- 2 Bottom View

3 Structure

3.1 Dimension Diagram of Structure





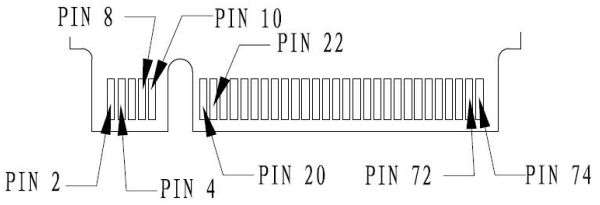


Figure 3- 1 Dimension Diagram of Structure

3.2 Application Interface Description

H380 M.2 module uses 75-pin gold fingers as the external interface,the size of the module please refer to the section 3.1.As shown in Figure 4-2, H380 M.2 module uses the 75-pin fingers interface(pin 67 is the signal interface and Pin 8 is notch) .About the naming rules of M.2, H380 adopts the Type 2242-S3-B (22mmx42mm,the maximum thickness of element layer of Top surface is 1.5mm , the thickness of PCB is 0.8mm , Key ID is B) .

Module Nomenclature
Sample Type 2242-D2-B-M

Type XX XX - XX - X - X[0]

Width (mm)
12
16
22
30

Length (mm)
16
26
30
42
60
80
110

Lable**	Component Max Ht (mm)	
	Top Max	Bottom Max
S1	1.2	0****
S2	1.35	0****
S3	1.5	0****
D1	1.2	1.35
D2	1.35	1.35
D3	1.5	1.35
D4	1.5	0.7
D5	1.5	1.5

Key ID	Pin	Interface
A	8-15	2x PCIe x1 / USB 2.0 / I2C / DP x4
B	12-19	PCIe x2/SATA/USB 2.0/USB 3.0/HSIC/SSIC/Audio/UIM/I2C
C	16-23	Reserved for Future Use
D	20-27	Reserved for Future Use
E	24-31	2x PCIe x1 / USB 2.0 / I2C / SDIO / UART / PCM
F	28-35	Future Memory Interface (FMI)
G	39-46	Generic (Not used for M.2)***
H	43-50	Reserved for Future Use
J	47-54	Reserved for Future Use
K	51-58	Reserved for Future Use
L	55-62	Reserved for Future Use
M	59-66	PCIe x4 / SATA

* Use ONLY when a double slot is being specified
** Label included in height dimension
*** Key G is intended for custom use. Devices with this key will not be M.2-compliant. Use at your own risk!
**** Insulating label allowed on connector-based designs

3.3 M.2 Connector

Recommend to use the M.2 connector from LOTES, the type is APCI0026-P001A, the package of connector design please refer to the relevant specifications .

As shown in Figure 3-2:

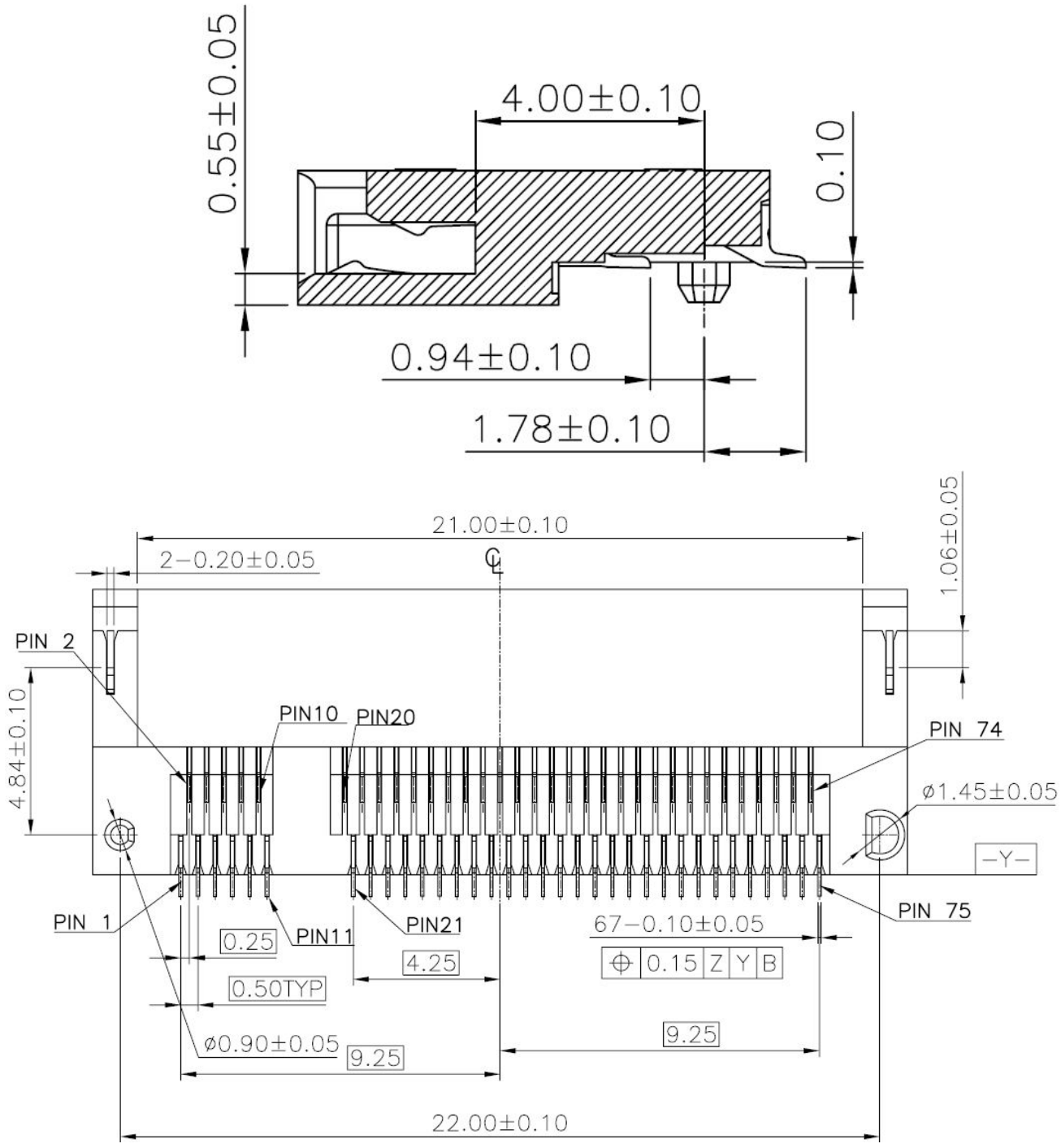


Figure 3- 2 APCI0026-P001A M.2 connector dimension

4 Hardware Introduction

4.1 Hardware Diagram

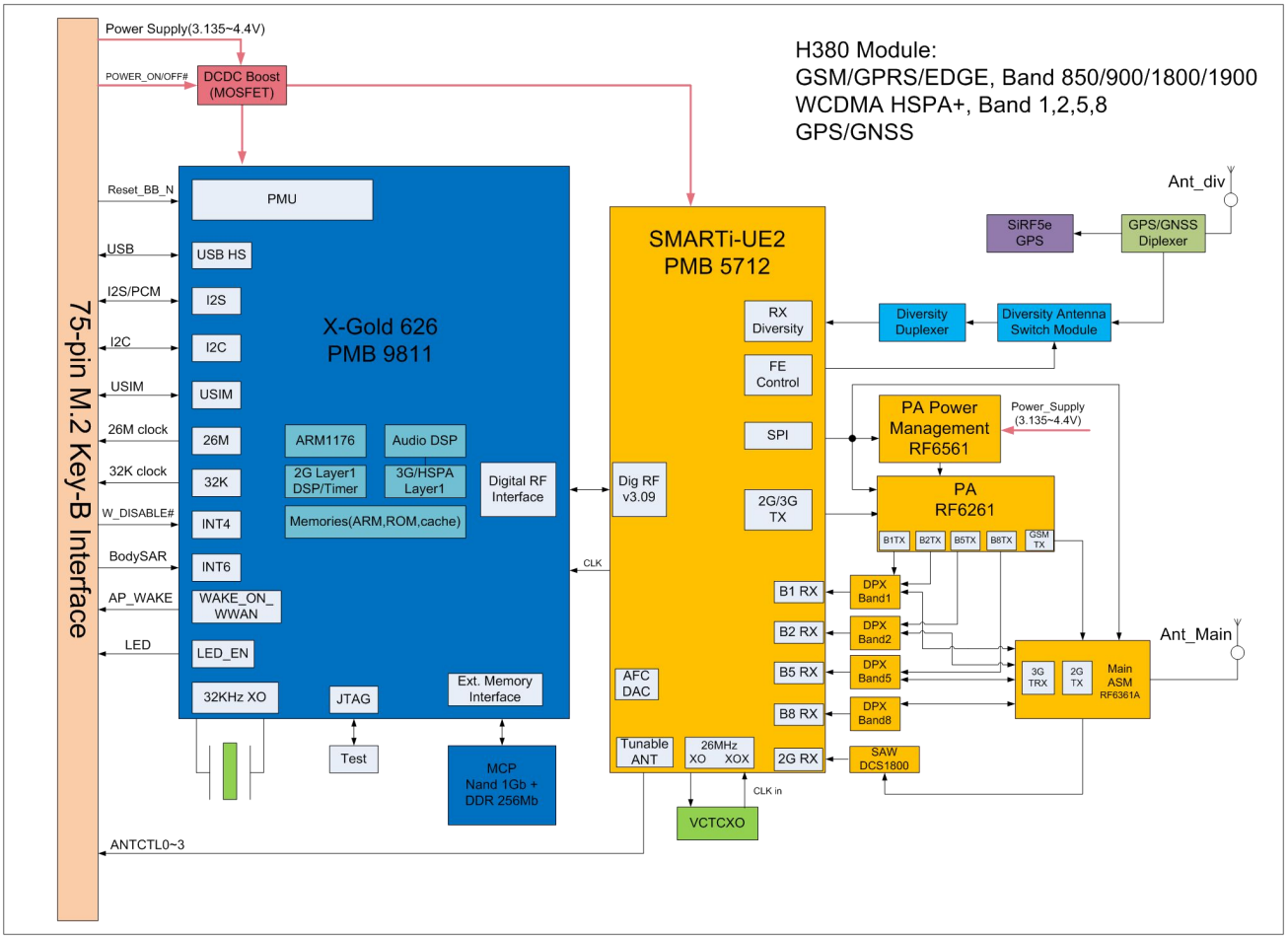


Figure 4- 1 Block Diagram

4.2 Pin Definitions

4.2.1 Pin Map

74	+3.3V	CONFIG_2	75
72	+3.3V	GND	73
70	+3.3V	GND	71
68	CLK32K	CONFIG_1	69
66	SIM_DETECT	RESET#	67
64	NC	ANTCTL3	65
62	NC	ANTCTL2	63
60	NC	ANTCTL1	61
58	NC	ANTCTL0	59
56	NC	GND	57
54	NC	NC	55
52	NC	NC	53
50	NC	GND	51
48	TX_BLANKING	NC	49
46	SYSCLK	NC	47
44	GNSS_IRQ	GND	45
42	GNSS_SDA	NC	43
40	GNSS_SCL	NC	41
38	NC	GND	39
36	UIM_PWR	NC	37
34	UIM_DATA	NC	35
32	UIM_CLK	GND	33
30	UIM_RESET	NC	31
28	I2S_WA	NC	29
26	W_DISABLE2#	GND	27
24	I2S_RX	DPR	25
22	I2S_TX	WOWWAN#	23
20	I2S_CLK	CONFIG_0	21
	Notch	Notch	
	Notch	Notch	
	Notch	Notch	
	Notch	Notch	
10	LED1#(3.3V)	GND	11
8	W_DISABLE1#(3.3V)	USB D-	9
6	FUL_CARD_POWER_OFF#(1.8V)	USB D+	7
4	+3.3V	GND	5
2	+3.3V	GND	3
		CONFIG_3	1

Figure 4-2 Pin Diagram (TOP View)

4.2.2Description of Pins

Pins of H380 M.2 series are described in the table below:

Pin#	H380 PIN Name	I/O	Reset Value	Idle Value	Description
1	CONFIG_3	O	L	L	The inside connect with GND，H380 M.2 module shall configure as the WWAN-SSIC 0 interface type.
2	+3.3V	PI			Main power supply, voltage range: 3.135V ~ 4.4V
3	GND				GND
4	+3.3V	PI			Main power supply, voltage range: 3.135V ~ 4.4V
5	GND				GND
6	FUL_CARD_POWER_OFF#	I	PU	PU	Power off control signal, internal 47K pull-up resistor,CMOS 1.8V.
7	USB D+	I/O			USB signal +
8	W_DISABLE1#	I	PU	PU	WWAN Disable,Low active,CMOS 3.3V
9	USB D-	I/O			USB signal -
10	LED1#	O	OD	OD	System status LED, drain output , active low , CMOS 3.3V
11	GND				GND
12	Notch				Notch
13	Notch				Notch
14	Notch				Notch
15	Notch				Notch
16	Notch				Notch
17	Notch				Notch
18	Notch				Notch
19	Notch				Notch
20	I2S_CLK	O	T	T	I2S series clock，CMOS 1.8V

21	CONFIG_0				NC
22	I2S_TX	O	T	T	I2S serial data input，CMOS 1.8V
23	WOWWAN#	O	PU	PU	The module wake-up Host device signal, active low, CMOS 1.8V
24	I2S_RX	I	T	T	I2S serial data input, CMOS 1.8V
25	DPR	I			Body SAR Detect，CMOS 1.8V
26	W_DISABLE2#	I	PU	PU	GPS Disable signal, active low, CMOS 1.8V（not supported yet）
27	GND				GND
28	I2S_WA	O	T	T	I2S left and right channel clock (LRCK) , CMOS 1.8V
29	NC				NC
30	UIM_RESET	O	PP	PP	USIM card reset signal
31	NC				NC
32	UIM_CLK	O	PP	PP	USIM card clock signal
33	GND				GND
34	UIM_DATA	I/O	PU	PU	USIM card data signal，internal 4.7K pull-up resistor
35	NC				NC
36	UIM_PWR	O			SIM card power supply output，1.8V/3.0V
37	NC				NC
38	NC				NC
39	GND				GND
40	GNSS_SCL	O	PU	PU	I2C series data clock signal，internal 4.7K pull-up resistor，CMOS 1.8V
41	NC				NC
42	GNSS_SDA	I/O	PU	PU	I2C series data signal data, internal 4.7K pull-up resistor，CMOS 1.8V

43	NC				NC
44	GNSS_IRQ	I	PU	PU	Win8/Android dual system switch interrupt input signal,CMOS 1.8V
45	GND				GND
46	SYSCLK	O	L	L	26MHz clock signal output
47	NC				NC
48	TX_BLANKING	O	L	L	GSM TDMA Timer output signal，External GPS control signal , CMOS 1.8V
49	NC				NC
50	NC				NC
51	GND				GND
52	NC				NC
53	NC				NC
54	NC				NC
55	NC				NC
56	NC				NC
57	GND				GND
58	NC				NC
59	ANTCTL0	O	L	L	Tunable antenna control signal, bit0, CMOS 1.8V（not supported yet）
60	NC				NC
61	ANTCTL1	O	L	L	Tunable antenna control signal, bit1, CMOS 1.8V（not supported yet）
62	NC				NC
63	ANTCTL2	O	L	L	Tunable antenna control signal, bit2, CMOS 1.8V（not supported yet）
64	NC				NC
65	ANTCTL3	O	L	L	Tunable antenna control signal, bit3, CMOS 1.8V（not supported yet）
66	SIM_DETECT	I			SIM Detect，CMOS 1.8V

67	RESET#	I	PU	PU	External reset signal input，CMOS 1.8V
68	CLK32K	O			32KHz clock output
69	CONFIG_1	O	L	L	The inside connect with GND，H380 M.2 module shall configure as the WWAN-SSIC 0 interface type.
70	+3.3V	PI			Main power supply input , voltage range: 3.135V ~ 4.4V
71	GND				GND
72	+3.3V	PI			Main power supply input , voltage range: 3.135V ~ 4.4V
73	GND				GND
74	+3.3V	PI			Main power supply input , voltage range: 3.135V ~ 4.4V
75	CONFIG_2	O	L	L	The inside connect with GND，H380 M.2 module shall configure as the WWAN-SSIC 0 interface type.

PI：Power Input

H：High Voltage Level

L：Low Voltage Level

PD：Pull-Down

PU：Pull-Up

T：Tristate

OD：Open Drain

PP：Push-Pull

5 Hardware Interface

5.1 Power Interface

5.1.1Power Supply

H380 M.2 modules require 3..135V ~ 4.4V direct current power supply, which can provide the maximum GSM emission current of 2A.

Input power supply requirements:

Parameter	Minimum Value	Recommended Value	Maximum Value	Unit
+3.3V	3.135	3.3	4.4	V

Points for attention in design:

1. Supply voltage fluctuation shall be lower than 200mV.

2. Minimum supply voltage drop shall be higher than 3.135V.

The filter capacitor design of power supply circuit as follows:

Recommended capacitor	Application	Description
1000uF	Supply capacitance	Reduce power-supply fluctuation during phone call.The capacitance value bigger is better
10nF, 100nF	Digital signal noise	Filter the interference caused by clock and digital signals
8.2pF, 10pF	1800/1900/2100 MHz 频段	Filter RF interference
33pF, 39pF	850/900 MHz 频段	Filter RF interference

5.1.2Consumption

The consumption of H380 M.2 series module as listed below :

Parameter	Description	Condition		Typical Value (3.3V)	Unit
I_{OFF}	RTC mode			100	uA
I_{SLEEP}	Low power mode (GSM)	DRX	2	2.86	
			5	2.56	mA

			9	2.26	
	Low power mode (WCDMA)	DRX	6	3.16	mA
			8	2.46	
			9	2.36	
$I_{GSM-RMS}$	GSM voice -1 TX slot 1 RX slot Peak current During TX slot	GSM850 PCL	5	265.4	mA
			10	104.2	
			15	73.6	
			19	69.2	
		EGSM900 PCL	5	270.2	
			10	107.0	
			15	73.9	
			19	69.2	
		DCS1800 PCL	0	185.8	
			5	94.1	
			10	71.4	
			15	67.7	
		PCS1900 PCL	0	187.8	
			5	97.3	
			10	72.7	
			15	69.7	
$I_{GSM-MAX}$		GSM850 PCL	5	1999.9	mA
			10	507.5	
			15	177.6	
			19	141.3	
		EGSM900 PCL	5	2189.2	
			10	503.9	
			15	194.1	
			19	157.2	
		DCS1800 PCL	0	1335.8	

			5	394.6	
			10	165.3	
			15	140.9	
		PCS1900 PCL	0	1473.1	
			5	395.7	
			10	178.9	
			15	149.7	
I_{GPRS}	GSM850 PCL=5	GSM voice - 1RX slot TX slot	1	271.8	mA
			4	408.3	
	GSM850 PCL=10		1	91.8	
			4	232.4	
	EGSM900 PCL=5		1	251.7	
			4	428.1	
	EGSM900 PCL=10		1	90.6	
			4	234.3	
	DCS1800 PCL=0		1	175.7	
			4	305.3	
	DCS1800 PCL=10		1	78.8	
			4	123.0	
	PCS1900 PCL=0		1	205.2	
			4	326.1	
	PCS1900 PCL=10		1	78.8	
			4	124.1	
$I_{EGPRS-RMS}$	GSM850 PCL=8	GSM voice - 1RX slot TX slot	1	216.5	mA
			4	581.1	
	GSM850 PCL=15		1	82.2	
			4	130.6	
	EGSM900 PCL=8		1	213.2	
			4	578.9	

	EGSM900 PCL=15		1	88.7	
			4	156.7	
	DCS1800 PCL=2		1	230.7	
			4	565.6	
	DCS1800 PCL=10		1	87.9	
			4	134.0	
	PCS1900 PCL=2		1	234.7	
			4	582.7	
	PCS1900 PCL=10		1	87.1	
			4	133.1	
$I_{WCDMA-RMS}$	WCDMA	Band1	24dBm	639.4	mA
			10dBm	202.3	
			1dBm	148.0	
		Band2	24dBm	662.4	
			10dBm	200.4	
			1dBm	148.7	
		Band5	24dBm	442.9	
			10dBm	180.8	
			1dBm	142.7	
		Band8	24dBm	492.0	
			10dBm	183.0	
			1dBm	148.4	

5.2 Power on/off and Reset Signal

5.2.1 Pins Definition of Power on/off Control Signal

H380 M.2 wireless modules provide two control signals to power on /power off and reset the modules.

Pins definition as listed below :

Pin#	Pin Name	Electrical Level	Description
6	FUL_CARD_POWER_OFF#	CMOS 1.8V	Power on/off signal
67	RESET#	CMOS 1.8V	External reset signal input

5.2.2 Power on /off Signal

After the M.2 module is connected to the power supply, the user can through pull up the signal of " FUL_CARD_POWER_OFF# " and last for 300ms, to make the module power on.

Power on Timing Control Diagram as below:

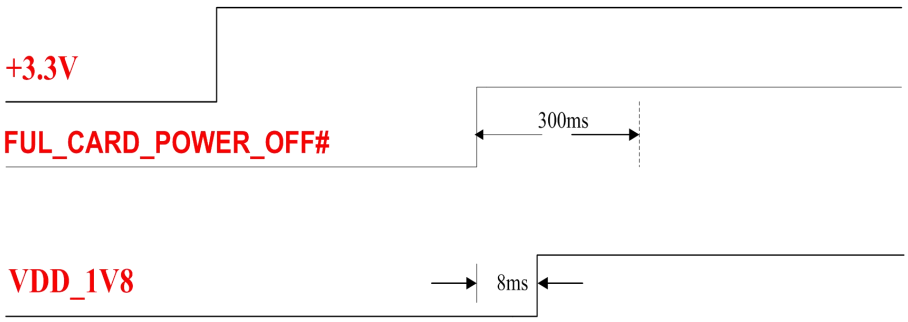


Figure 5- 1 Power on Timing Control Diagram

Pull down the signal of FUL_CARD_POWER_OFF# and last for 100ms, the M.2 module be power off.

Power off Timing Control Diagram as below:

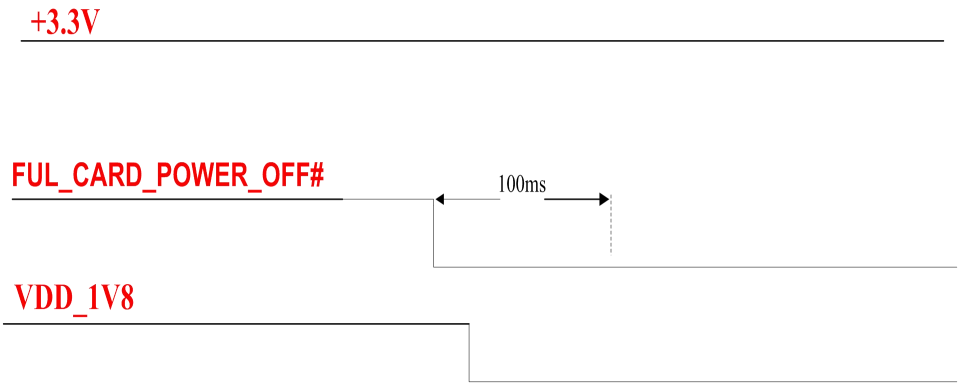


Figure 5- 2 Power off Timing Control Diagram

The recommended design of FUL_CARD_POWER_OFF# signal is as follows:

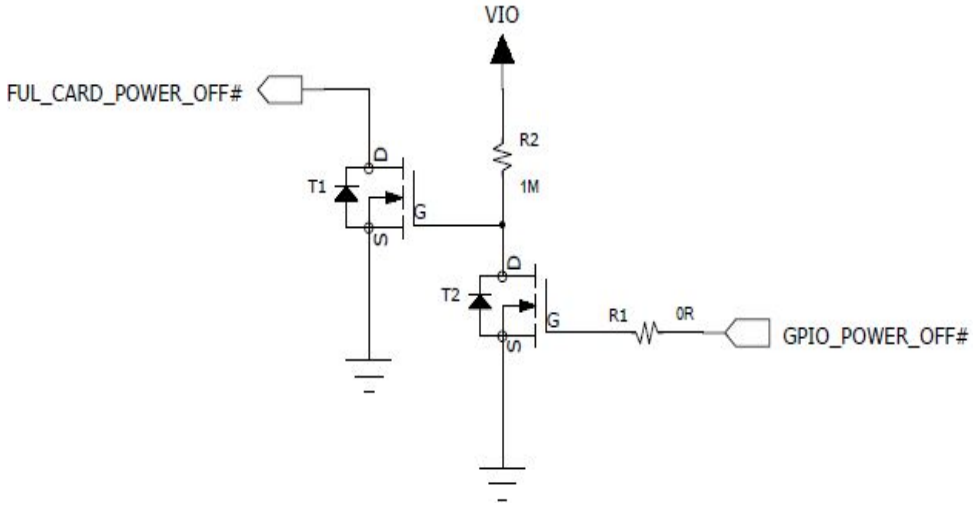


Figure 5- 3 Recommended Design of FUL_CARD_POWER_OFF# Signal

5.2.3RESET Signal

H380 M.2 wireless modules support external reset function. It is feasible to reset the module back to the original state by the Reset Signal.

When setting the Reset Signal low for 100ms, the module will be reset and restarted. When the user uses the Reset function, the PMU inside the module will not lose power.

Note: Reset signal is a sensitive signal line. In designing PCB layout, please keep the line away from RF interference, and make it well wrapped with ground wire. And it is advised to add an anti-shaking capacitor at the place close to the module end.At the same time, Reset_N signal line shall avoid the PCB edge and the surface, then reset the ESD can be avoided.

The timing sequence requirements of its pulse are as follows:

Parameters	Condition	Minimum Value	Typical Value	Maximum Value	Unit
Pulse Width		100	300	3000	ms

Recommended design:

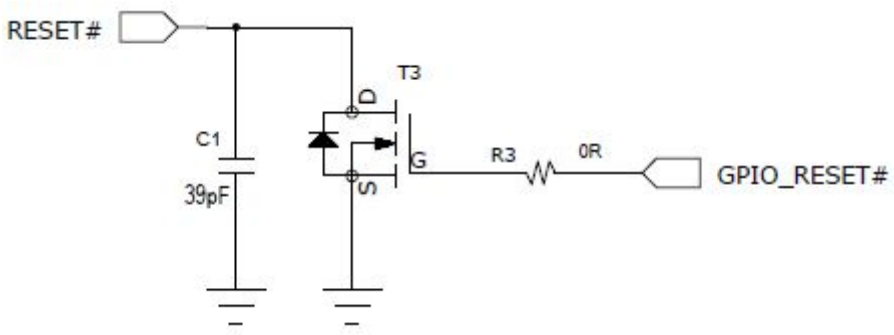


Figure 5- 4 Reset# Circuit Recommended Design

5.3 Status Indicating Signal

5.3.1 Status Indicating Pin

H380 M.2 modules provide drain output signal for indexing RF status.

Pin#	Pin Name	Description
10	LED1#	Close or open RF network status index, ,CMOS 3.3V

LED1 # signal description as listed below :

No	Status	LED1#
1	RF function opened	Low level
2	RF function closed	High level

Recommended design:

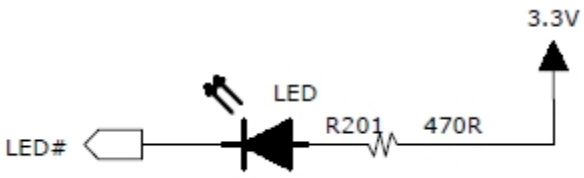


Figure 5- 5 Recommended design of LED Status Index

5.4 USB Interface

5.4.1 USB Interface Definition

Pin#	Pin Name	I/O	Description
7	USB_DP	I/O	USB signal+
9	USB_DM	I/O	USB signal-

H380 M.2 wireless modules support USB 2.0. Before connecting it to PC, it is necessary to install the related USB driver.

After inserting the H380 M.2 wireless modules to PC, the USB interface will work with the driver and map seven ports on PC-side, as follows:

- One 3G Modem/AT port for initiating data traffic.
- Three ports for dispatching AT Command.
- One ports for capturing LOG information of the software.
- Two port reserved for future use.

5.4.2USB Interface Application

Reference Circuit Design:

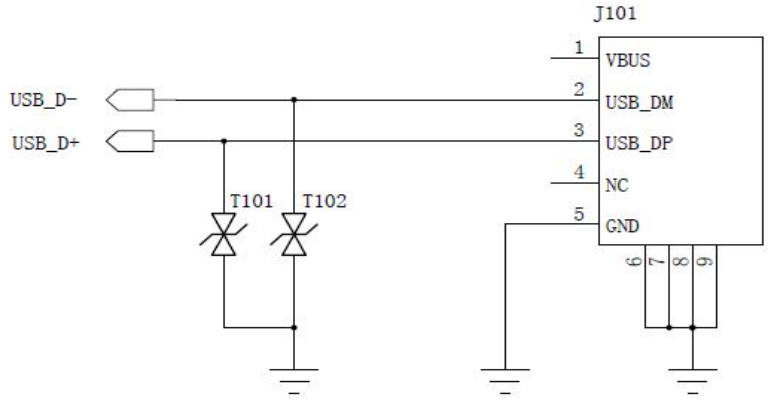


Figure 5-6 USB Interface Reference Circuit Design

T101 and T102 shall be TVS with capacitance lower than 1pF .

VUSB power supply has built connected within the module, so the VBUS PIN of Host side can be floating.

USB_D+ and USB_D- are the high-speed differential signal line, and their highest transmission rate is 480Mbps. The following requirements should be followed in designing PCB layout.

- USB_D+ and USB_D- signal lines should have the same length, and should be parallel; avoid right angle wiring.
- USB_D+ and USB_D- signal lines should be wrapped with GND at the ends.
- USB2.0 differential signal line should be laid at the signal layer closest to the ground layer.
- USB signal line shall be far away from stronger interference signal, such as power supply.
- Ensure impedance matching; impedance is required to be 90ohm.

5.5 USIM Interface

H380 M.2 series wireless modules support USIM and high speed SIM cards. But 8-line intelligent USIM is not supported yet.

5.5.1USIM Pins

Pin#	Pin Name	I/O	Function Description
36	UIM_PWR	O	USIM power supply signal
30	UIM_RESET	O	USIM Reset Signal
32	UIM_CLK	O	USIM clock signal
34	UIM_DATA	I/O	USIM data signal
66	SIM_DETECT	I	USIM Plug-in detection signal , 390K resistor will be pulled up by default. High level indicates that SIM card is inserted. Low level indicates that card is not inserted.

5.5.2USIM Interface Design

5.5.2.1“Normal Closed”SIM Card Circuit Design

Reference Circuit Design :

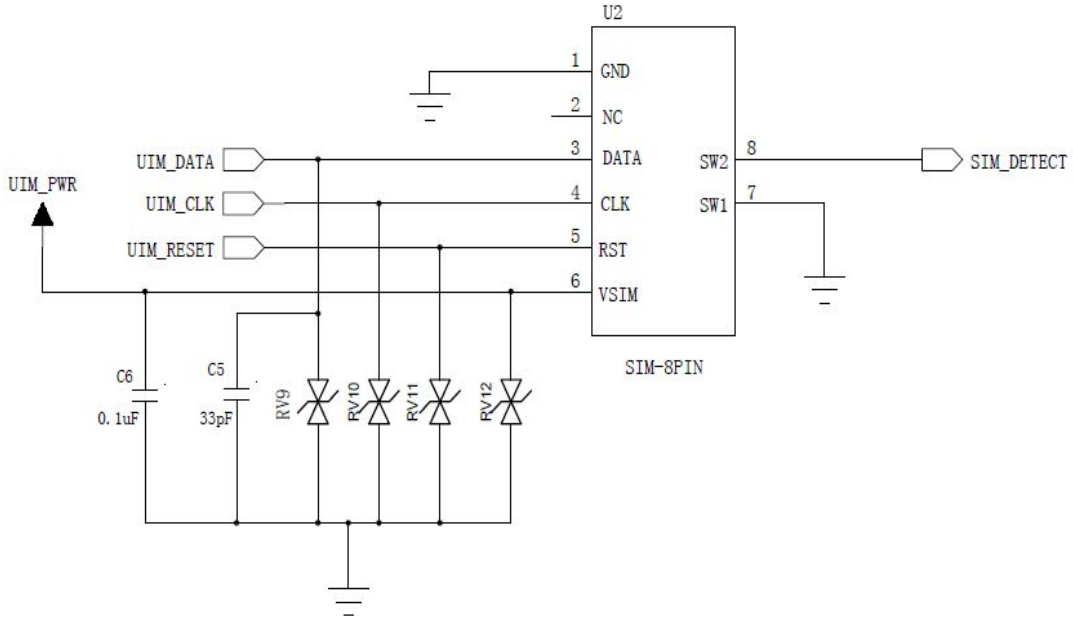


Figure 5-7 Reference Design of “Normally Closed” SIM Card Interface

Normally closed SIM Connector:

1）Pull out SIM card, pin 7 and pin 8 will short-circuit .

2）Insert SIM card, pin 7 and pin 8 will disconnect.

5.5.2.2“Normally Open” SIM Circuit Design

Referenced Circuit Design:

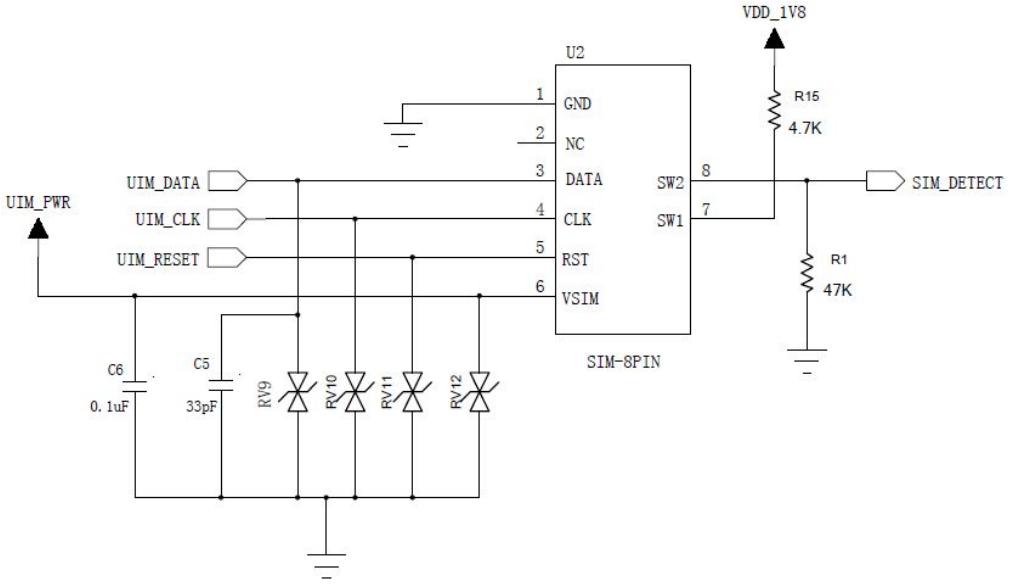


Figure 5-8 Reference Design of “Normally Open” SIM Card Interface

Normally Open SIM Connector:

1）Pull out SIM card, pin 7 and pin 8 will disconnect.

2）Insert SIM card, pin 7 and pin 8 will short-circuit

Note:

- In order to improve EMC performance, the SIM card slot should be close to the module to the largest extent.
- The filter capacitor on the SIM-card signal circuit should be placed close to SIM card pin to the largest extent.
- ESD device (like TVS) shall be added to the SIM-card signal circuit protection. ESD device should be placed close to SIM card pin.
- SIM1_DETECT signal connection supports hot-plugging; active high level by default(change to active low through AT commands). If the module detects the signal at high level, it means there is a card in the module.

5.5.3Points for Attention in USIM Design

SIM card interface design is very important for the normal operation of the module and SIM card.

The following points need to be complied with during the design:

- SIM card layout and wiring must keep away from EMI interference source, like RF antenna and digital switch signal.
- In order to ensure signal completeness, the wire distance between the module and SIM card should not exceed 100mm.
- In order to avoid mutual interference, USIM_CLK and USIM_IO signals should be separated in wiring. It would be best to wrap them with ground wire respectively.
- SIM card signal line should be protected with ESD. These protective devices should have small capacitance (like Zener diode, etc.). Users are recommended to select ESD devices with equivalent capacitance lower than 33pF. During layout, ESD device should be close to the SIM card interface.

5.5.4USIM Hot-Plugging

H380 M.2 module supports SIM card status-detection function. This function allows the hot-plugging of SIM card.

5.5.4.1Hardware Connection

SIM card hot-plugging function needs to work with SIM_DETECT signal.

SIM_DETECT will be at low level without SIM card; after inserting SIM card, SIM_DETECT will be at high level.

Note :

- For “Normal closed” SIM card, as shown in the figure5-7, SIM_DETECT signal line is connected to U2’s Pin8 (SW2), and Pin7 (SW1) is connected to the ground. When the SIM card is not inserted, SW2 and SW1 short circuit, SW2 will be at low level. When the SIM card is inserted, SW2 and SW1 will be disconnected, SIM_DETECT level will be pulled up.
- For “Normal opened” SIM card, as shown in the figure5-8, SIM_DETECT signal line is connected to U2’s Pin8 (SW2), and Pin7 (SW1) will be pulled up 4.7K resistor . When the SIM card is not inserted, SW2 and SW1 will be disconnected, then SW2 will be at low level. When the SIM card is inserted, SW2 and SW1 will short circuit, SIM_DETECT level will be pulled up.

5.5.4.2Software Settings

“+MSMPD” configures AT command for the SIM card status-detection function.

- If set AT+MSMPD=0, SIM card status-detection function will be closed, and the module will not detect SIM_DETECT signal.
- If set AT+MSMPD=1, SIM card status-detection function will be in opened, and the module will detect if the SIM card is inserted by SIM_DETECT Pin.
- If SIM_DETECT is at high level, which indicates SIM card is inserted, the module will automatically register it to the network.
- If SIM_DETECT is at low level, which indicates SIM card is not inserted, the module will not register it to the network.

Note: the default of +MSMPD parameter is “1”.SIM_DETECT is the detection signal. While the module first power on or plug after that, SIM_DETECT will detect if the SIM card is existing or not. Just only if the SIM_DETECT is low level, the module will cannot read SIM card.

5.6 Digital Audio

H380 M.2 module supports digital audio I2S interface that supports normal I2S mode and PCM mode. I2S interface level is 1.8V on average.

I2S signal description:

Pin#	Pin Name	I/O	Description
20	I2S_CLK	O	Bit Clock
28	I2S_WA	O	Left and right channel clock (LRCK)
22	I2S_TX	O	Serial data output

24	I2S_RX	I	Serial data input
42	GNSS_SDA	I/O	I2S control signal input/output
40	GNSS_SCL	O	I2S control clock signal

5.6.1I2S

H380	Signal Direction	Audio CODEC I2S Port
I2S_CLK	→	I2S_CLK
I2S_WA	→	I2S_LRCK
I2S_RX	←	I2S_SDOUT
I2S_TX	→	I2S_SDIN
SYSCLK	→	I2S_MCLK

5.6.2I2C

H380	Signal Direction	Audio CODEC I2C Port
GNSS_SDA	↔	I2C_SDA
GNSS_SCL	→	I2C_SCL

Description:

- I2S interface can be configured as client-server work mode.
- Suitable for various audio sampling frequencies(48KHz, 44.1KHz, 32KHz, 24KHz, 22.5KHz, 16KHz, 12KHz, 11.025KHz and 8KHz).

5.6.3PCM Port Description

H380	Signal Direction	Audio CODEC PCM Port
I2S_CLK0(PCM_CLK ,PCM clock signal)	→	PCM_CLK（PCM clock signal）
I2S_WA0(PCM_SYNC , PCM frame synchronization signal)	→	PCM_SYNC（PCM frame synchronization signal）
I2S_RX(PCM_DIN , PCM data input)	←	PCM_DOUT（PCM data output）
I2S_TX(PCM_DOUT , PCM data output)	→	PCM_DIN（PCM data input）

Note:

- PCM interface can be configured as client-server work mode.
- Support short frame synchronization at 16, 32, 48, and 64 bit mode
- Support burst and continuous mode transmission
- Suitable for various audio sampling frequencies(48KHz, 44.1KHz, 32KHz, 24KHz, 22.5KHz, 16KHz, 12KHz, 11.025KHz and 8KHz).

5.7 Win8/Android Switch Control Interface

H380 M.2 module supports the Win8/Android dual system switch. Check and achieve the switch function through interrupt signal ”GNSS_IRQ”.

Pin#	Name	I/O	Description
44	GNSS_IRQ	I	The detection signal of Win8/Android dual system switch, CMOS 1.8V

The definition of GNSS_IRQ signal function as listed below :

No.	GNSS_IRQ	Function
1	High/Floating	Win8 system supports, the module`s USB ports shall set as MBIM mode.
2	Low	Android system supports, the module`s `USB ports shall set as 7ACM modes.

Note：

1. Check and achieve the Win8/Android system switch through GNSS_IRQ level while module starting . Keep the GNSS_IRQ level stability during starting.
2. Check and achieve the Win8/Android system switch through GNSS_IRQ rising edge/ falling edge while the module starting. The debouncing time sets as 100ms. The module will reboot once meeting all the requirements and switch different system supports.

5.8 W_DISABLE# Interface

5.8.1 Description of WWAN_DISABLE# Interface

H380 M.2 module supports open/close the WWAN RF functional signal through hardware, and this function can also be controlled by AT commands.

Pin#	Name	I/O	Description
8	W_DISABLE1#	I	WWAN on/off signal,CMOS 3.3V

The definition of W_DISABLE# signal as listed below:

No.	W_DISABLE#	Function
1	Low	WWAN off
2	High	WWAN on
3	Floating	WWAN function is controlled by AT commands, it is on by default.

5.8.2GPS_DISABLE# Interface

H380 M.2 module supports open/close GPS functional signal, and this function is also controlled by AT commands.

Pin#	Name	I/O	Description
26	W_DISABLE2#	I	GPS on/off signal , 1.8V

The definition of GPS_DISABLE# signal as listed below:

No.	GPS_DISABLE#	Function
1	Low	GPS off
2	High	GPS on
3	Floating	GPS function is controlled by AT commands, it is on by default.

Note : This function is not supported yet.

5.9 TX_BLANKING Interface

Output the low level by default. While the module works in GSM bands, TX_BLANKING will output the pulse signal that synchronized with GSM burst timing sequence. Because of the GSM TX will interface GPS signal receiving, suggest to close GPS or stop GPS data receiving while AP has detected the TX_BLANKING pulse signal.

Pin#	Name	I/O	Description
48	TX_BLANKING	O	External GPS control signal

5.10 WAKEUP Host Interface

H380 M.2 module supports WAKEUP_Host ,the pin is high level by default. Output low level while awaking host.

Pin#	Name	I/O	Description
23	WOWWAN#	O	H380 M.2 module wakes up the Host signal, 1.8V signal，low level is available

5.11BODY_SAR Interface

H380 M.2 module supports BODY_SAR（DPR pin）.

BODY_SAR is input signal(this signal is output by AP-side) and with high level by default. Low level is available. AP can detect the human body`s nearing through distance sensor, then output the BODY_SAR signal with low level. Once the module detect the signal through interrupt detection, it will reduce the TX power. The reduced threshold value can be set by AT commands.

Pin#	Name	I/O	Description
25	DPR	I	BODY_SAR detection

5.12 Clock Interface

H380 M.2 module supports a 26MHz clock output and a 32KHz clock output.

Pin#	Name	I/O	Description
46	SYSCLK	O	26MHz clock output (recommend the external GPS to use it, and can also use as MCLK of audio codec)
68	CLK32K	O	32KHz clock output

5.13 Config Interface

H380 M.2 module supports 4 config pins and the module is configured to WWAN-SSIC 0.

PIN#	Pin Name	I/O	Description	Value
1	CONFIG_3	O	The internal connect to GND	0
21	CONFIG_0	O	NC	-
69	CONFIG_1	O	The internal connect to GND	0

75	CONFIG_2	O	The internal connect to GND	0

The configuration of H380 M.2 Socket 2 Module type as listed below :

Config_0 (pin21)	Config_1 (pin69)	Config_2 (pin75)	Config_3 (pin1)	Module Type and Main Host Interface	Port Configuration
GND	GND	GND	GND	SSD-SATA	N/A
GND	GND	N/C	GND	WWAN-PCIe	N/A
N/C	GND	GND	GND	WWAN-SSIC	0

5.14 RF Interface

5.14.1 RF Connector Interface

H380module provide 2 RF connected interface, used for the connection of external antenna. D/G is the Diversity/GPS Aux RF connector，MAIN is the main antenna of RF.

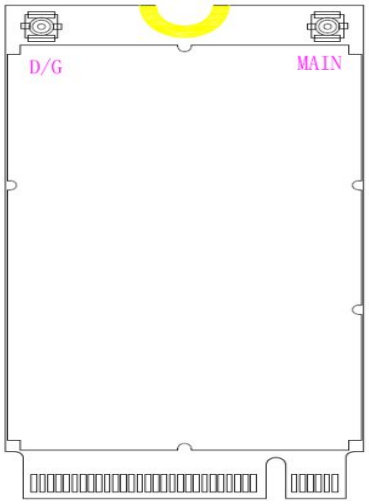


Figure 5-9 RF connector diagram

5.14.2 RF Connecting Seat

H380 M.2 module adopts the Murata MM4829-2702 RF connecting seat.
The dimension is 2.0*2.0*0.6mm. The structure diagram as follows :

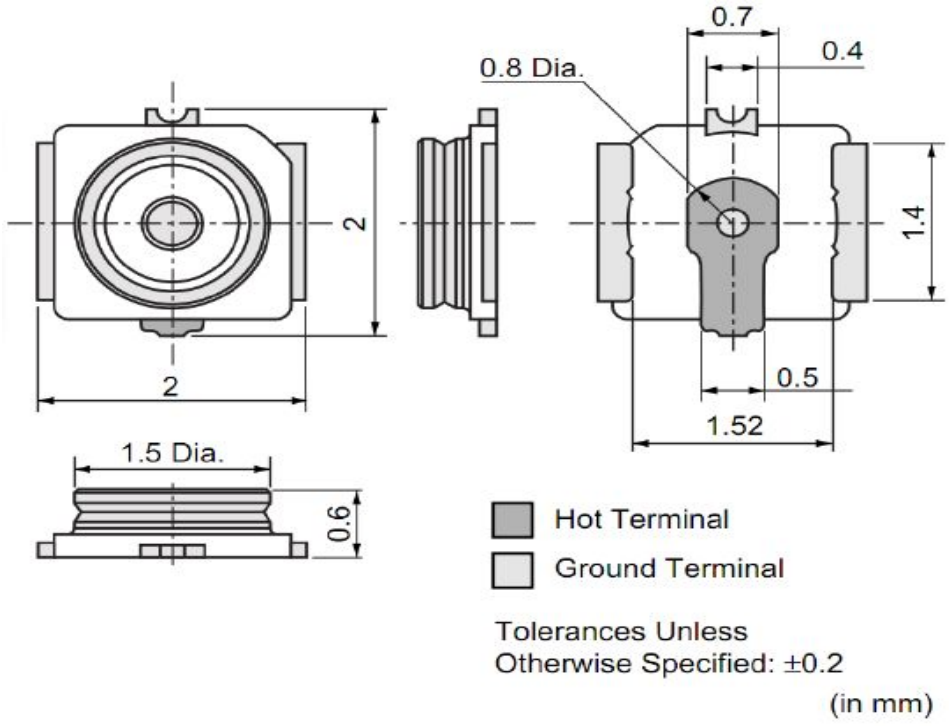


Figure 5-10 Structure diagram of RF connecting seat

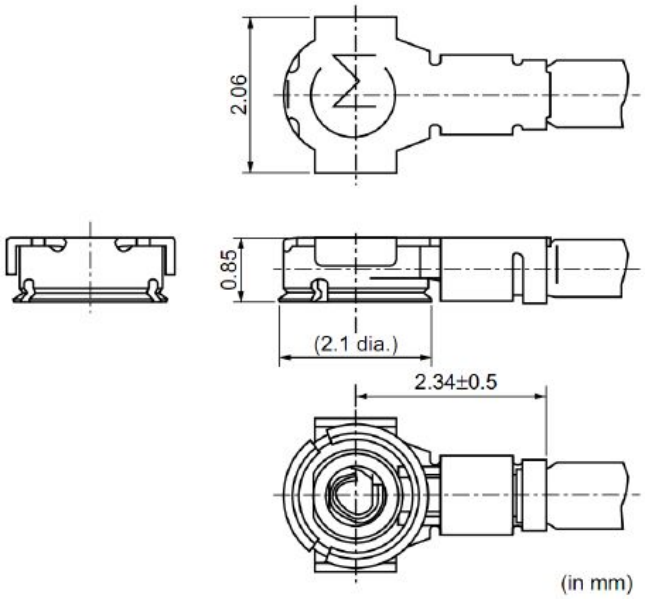


Figure 5-11 0.81mm coaxial cable matching RF connector

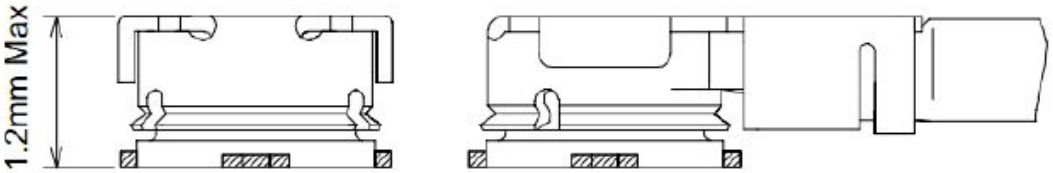


Figure 5-12 the RF connector insert into RF connecting seat

5.14.3 Main Performance of RF Connector

Rated condition		Environmental condition
Frequency range	DC to 6GHz	Temperature range:
Characteristic impedance	50Ω	–40°C to +85°C

5.15 Other Interfaces

H380 M.2 module does not support the GPIO and Tunable ANT interface yet.

6 Electrical and Environmental Features

6.1 Electrical Features

The table below lists the range of H380's electrical characteristics:

Parameters	Minimum Value	Maximum Value	Unit
Power supply signal	0	4.4	V
Digital signal	0	1.9	V

6.2 Environmental Features

This table below shows the environmental features of H380.

Parameters	Minimum Value	Maximum Value	Unit
Operational Temperature	-30	+75	°C
Storage Temperature	-40	+85	°C

7 RF Interface

7.1 Operating Frequency Band

The RF operating frequency band as listed below:

Operating Band	Tx (MHz)	Rx (MHz)
UMTS 2100 (Band I IMT)	1920–1980 MHz	2110–2170 MHz
UMTS 1900 (Band II IMT)	1850–1910 MHz	1930–1990 MHz
UMTS 850 (Band V IMT)	824–849 MHz	869–894 MHz
UMTS 900 (Band VIII IMT)	880–915 MHz	925–960 MHz
GSM 850	824–849 MHz	869–894 MHz
GSM 900	880–915 MHz	925–960 MHz
DCS 1800	1710–1785 MHz	1805–1880 MHz
PCS 1900	1850–1910 MHz	1930–1990 MHz

7.1.1 Diversity Antenna Band

Operating Band	Rx (MHz)
UMTS 2100 (Band I IMT)	2110–2170 MHz
UMTS 1900 (Band II PCS)	1930–1990 MHz
UMTS 850 (Band V CLR)	869–894 MHz
UMTS 900 (Band VIII GSM)	925–960 MHz

7.2 RF PCB Design

7.2.1 Impedance Design

The impedance of RF signal line of antenna interface needs to be controlled at 50 ohm.

7.3 Antenna Design

7.3.1 Main Antenna Design Requirements

(1) Antenna efficiency

Antenna efficiency is the ratio of the input power and radiant power. Because of the antenna's return loss, material loss and coupling loss, the radiant power is always lower than the input power. The ratio is recommended to be > 40% (–4dB).

(2) S11 or VSWR

S11 shows the matching degree of the antenna's 50 ohm impedance, which affects antenna efficiency to a certain extent. It is feasible to use VSWR testing method to measure the index. It is recommended that S11 < –10dB.

(3) Polarization

Polarization is the rotation direction of the electric field of the antenna at the direction of the largest radiation.

It is recommended to use linear polarization; for diversity antenna, it is recommended to use different polarization directions from that of the main antenna.

(4) Radiation pattern

Radiation pattern refers to the electromagnetic field intensity at various directions in the far field of the antenna. Half-wave doublet antenna is the perfect terminal antenna. In the case of built-in antenna, it is recommended to use PIFA.

- Antenna area: H 6mm * W 10mm * L 100mm. It is recommended to use PIFA or IFA.
- Antenna radiation direction: Omni-directional.

(5) Gain and directivity

Antenna directivity refers to the electromagnetic field intensity at various directions of the electromagnetic wave. Gain is the combination of the antenna efficiency and antenna directivity. It is recommended that antenna gain ≤ 2.5dBi.

(6) Interference

In addition to antenna performance, other interference from the PCB will also affect the module performance. In order to ensure the high performance of the module, the interference must be under control. Suggestions: keep speaker, LCD, CPU, FPC wiring, audio circuit, and power supply away from the antenna; add appropriate separation and shielding devices, or conduct filtering on the path.

(7) TRP/TIS

TRP (Total Radiated Power)：

- W900/W850/W1900/W2100>19dBm
- GSM850/GSM900>28dBm
- DCS1800/PCS1900>25dBm

TIS (Total Isotropic Sensitivity)：

- W900/W850<-102dBm
- W1900/W2100<-103dBm
- GSM850/GSM900<-102dBm
- DCS1800/PCS1900<-102dBm

7.3.2Diversity Antenna Design

H380 series' diversity reception function is optional. If selected, it needs to add diversity antenna.

The design method of diversity antenna is the same as the main antenna. Its efficiency index is allowed to decrease by 3dB.

The isolation between the main antenna and the diversity antenna should be larger than 12dB.